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ABSTRACT

This study seeks to determine the relationship between students' perceptions of two-way audio/video distance classrooms and their perceptions of self-efficacy. Self-efficacy is defined as self-assessment of one's ability to be successful in this audio/video classroom situation. In addition, this study seeks to determine the relationship between students' perceptions of two-way audio/video distance classrooms and their satisfaction with the distance learning experience. Students (n=222) in two- way audio-video classes completed inventories that measured their perceptions of self-efficacy, satisfaction with learning in the distance environment, and perceptions of the key elements in the learning environment. Data collected for each measure were correlated to determine the relationship among these factors. Results of the analysis were mixed. Findings appear to indicate that either the students do not discriminate among these concepts or that these factors are very tightly integrated in this type of environment. Implications and interpretations of these findings, as well as suggestions for future research are explored. (Contains 1 table and 22 references.) (SLD)

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Foundations for Creating Effective Two-Way Audio/Video Distance Education Environments: Issues of Self-Efficacy

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This study seeks to determine the relationship between students' perceptions of two-way audio/video distance classrooms and their perceptions of self-efficacy. Where self-efficacy is defined as: self-assessment of one's ability to be successful in a two-way audio/video classroom. Additionally, this study seeks to determine the relationship between students' perceptions of two-way audio/video distance classrooms and their satisfaction with the distance learning experience.

222 students in two-way audio/video distance classes completed inventories that measured their: perception of self-efficacy in the distance education situation, satisfaction with learning in the distance learning environment, and perception of key elements in the two-way audio/video learning environment. The data collected for each measure (self-efficacy, satisfaction, and environmental perception) were correlated in order to determine the relationship between these factors. The results of the analysis were mixed. Findings appear to indicate that either students do not discriminate between these concepts or that these factors are very tightly integrated in this type of environment. The implications and interpretations of these findings, as well as suggestions for future research are explored in the discussion section.

There has been an increase in the growth and development of distance education programs. This increase is largely due to the explosion in technology that has occurred over the past decade. Although technology is often meant to aid people and make things easier or better, many of the advances have occurred at a rate that has left much of the population behind. Many people simply are not comfortable with the new technology or believe that it will hinder their ability to perform tasks (Rosen & Maguire, 1990; Mahmood & Medewitz, 1989). Our study extends the ideas of earlier authors to an environment that was created as a result of this technological explosion: two-way audio/video distance education classes. In particular, this study explores the environment in a two-way audio/video classroom, its relationship to students' self-efficacy, and ultimately its affect on the students' satisfaction with the learning experience.

For most people, two-way audio/video distance education environments are new experiences. New experiences by nature can be anxiety provoking. The coupling of a new experience with new technology provides an even greater potential for increased anxiety. Our study looks at how students perceive their ability to cope with the two-way audio/video technology given their perception of the environment. According to Bandura (1977) an individual's ability to cope with anxiety provoking situations is an issue of self-efficacy. If students are not able to cope with the learning environment, students will expend less effort and learning is unlikely to occur (Shunk, 1985).

Another important issue regarding self-efficacy in two-way audio/video classes, is students' willingness to participate. If students do not believe that they will be able to cope with and succeed in such an environment they are less likely to participate. Researchers have found that perceptions of efficacy with technology have influenced people's decision to utilize a given technology (Hill, Smith and Mann, 1987). This study seeks to determine if the same is true for using two-way audio/video technology in a distance education environment.

One cause for concern regarding self-efficacy is that the physical distance between classrooms, the students and the teachers can strip the class participants of the physical presence and comfort that can be found in a traditional

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classroom (Moore & Kearsley, 1996; Bruce & Shade, 1995). Two-way audio/video technology was originally seen as a solution for problems associated with the dispersion of members of the classroom. In essence, two-way audio/video was intended to promote the presence normally found in a face-to-face situation. In turn, this technology was supposed to foster increased interaction, thus creating a better and more satisfying learning experience for the students. To a certain extent, two-way audio/video has met these expectations (McIsaac & Gunawardena, 1996).

Support for two-way audio/video's ability to provide a medium that is equivalent to face-to-face in terms of interaction has also been supported by findings in the communications research. Researchers in this area found, when examining interactions between people over two-way audio/video versus face-to-face situations, that people tend to communicate equally well in either situation. With respect to communication, there were little differences between the two mediums (Sellen, 1995; Heeter, 1992). Unfortunately, once technology is incorporated into educational situations, issues of communication tend to lose their simplicity. Realizing this, Hillman, Willis and Gunawardena (1994) pointed out that although the two-way audio/video environment has the potential to provide real-time interaction, significant impediments might result if the student is not comfortable with the technology or if the technology is poorly implemented. We believe that students' perception of the physical environment in a two-way audio/video classroom will be related to their perceptions of self-efficacy in the classroom.

The idea that anxiety hinders learning has been well established (Eysenck, 1979; Darke, 1988). The same is true for students who have low self-efficacy (Schunk, 1985). It has been established that when students are anxious, they will feel less comfortable speaking in groups (Weinberger & Engelhart, 1976). In sum, given a large classroom with a number of anxious students and students with low self-efficacy, it is likely that the overall quality of interaction and success of a class will suffer. There are numerous ways to promote higher levels of self-efficacy, but one way is to establish a safe and comfortable environment. A safer friendlier environment will probably increase a person's level of self-efficacy, while the opposite will have an equal and opposite effect on their self-efficacy. In a traditional classroom where there are few and familiar environmental variables, creating this atmosphere is relatively simple. However, in a two-way audio/video classroom there are numerous and less familiar variables. In addition, the use of technology itself can be less familiar to some individuals and might lead to an increase in anxiety and a decrease in self-efficacy. (Rosen & Maguire, 1990; Mahmood & Medewitz, 1989).

The physical environment is one of the foundations on which a comfortable anxiety-free classroom is built. Careful planning of a two-way audio/video classroom can ease communication and interaction; failure to do so can be not only unhelpful, but detrimental (Cape, 1996). Although a plethora of techniques can aid in reducing and facilitating communication and interaction in the classroom, using any of these methods in the absence of a sound foundation is analogous to a well-conceived building placed on a fault line. In the end, these interventions would collapse into the base from which they were built. Careful planning and judicious support in a two-way audio/video classroom plays an important part in establishing a solid foundation.

There are several factors that should be addressed in order for a two-way audio/video class to be successful. Factors such as lighting, audio quality, table and monitor arrangement can all affect a student's anxiety level. In addition, unintelligible audio or video portions of the class can also create a whole new set of stressors that may hinder learning. Seeing oneself on a video monitor can be unnerving to some people, while to others it's a curiosity (Bruce & Shade, 1995). As such the technology in this environment can be particularly disconcerting for some individuals. For this reason, the availability and response time of technical support staff in this type of environment is another key variable. If a problem with the technology arises and it is not resolved quickly, the anxiety and frustration level of all participants is likely to increase and their views of self-efficacy can decrease. Essentially it is important that the technology, environment, and support work together seamlessly, lest the environment become intrusive and anxiety-provoking, compromising the level of interaction.

Although two-way audio/video classrooms have been around for over 40 years, there has been little empirical examination of physical environmental variables and, in particular, students' perceptions and satisfaction with them (Biner, Dean, & Mellinger, 1994). According to McIsaac and Gunawardena (1996) "... research is needed to identify how technology interacts with students and how it affects teaching and learning." Additionally, research on how the technology affects learners as well as the environmental conditions necessary for its implementation should be ongoing (McIsaac & Gunawardena, 1996.) This is especially true as the technology changes.

This study seeks to develop a method by which physical and environmental aspects as well as students perceptions' of self-efficacy in this type of environment and their overall satisfaction with their learning experience can be

assessed. Although many elements make up a solid foundation in the classroom environment, we believe that environmental variables are particularly relevant to students' self-efficacy, their satisfaction, and ultimately student success in the classroom. Furthermore, it is essential that educators and programmers take these elements into account when developing and conducting distance education classes. The level of success attained by the students, the instructors, and ultimately the distance education program can only be as good as the foundation on which it lies.

Method

Participants

The participants for the study were students enrolled in 12 separate two-way audio video classes at two major midwestern universities and two midwestern community colleges. The sample consisted of 222 subjects (146 female, 54 male, 22 non-reported; 93% Caucasian, 4% African American, 1% Hispanic, 1% Asian, 1% other). The age range for the sample was 18-64, with a modal age of 19 and a mean age of 31. 97% of the participants were native English speakers.

Instruments

The instruments used in this study included the following measures: perception of self-efficacy in a two-way audio/video education environment, general satisfaction with the distance learning experience, and student perception of environmental elements of the two-way audio/video classroom. Environmental variables were subdivided into three categories: perception of the physical environment, perception of the physical layout, and perception of the management of the distance learning environment.

The measures in this study were developed due to the lack of empirically validated instruments that assess these constructs. Developing these measures was a multi-step process. The initial items were developed through a combination of techniques. In the case of the self-efficacy measure, items were developed based on a variety of self-efficacy measures whose individual items were based on Bandura's (1977) original theory of self-efficacy. These items were then specifically tailored to address the learning environment in question, the two-way audio/video classrooms.

A similar approach was used for the development of a measure to assess satisfaction with the learning experience. Consumer satisfaction has been an important area of research in many fields (Ware, 1978; Lebow, 1982; Locke, 1976). In the past decade this area of research has gained interest in the area of education (Chadwick & Ward, 1987). As competition for students grows, particularly in distance education environments, schools will need to pay close attention to this variable lest their programs become victims of low retention and returns. Although the fields studied vary, each seems to tap a certain unidimensional factor in its assessment of consumer satisfaction. Larsen, Attkisson, Hargreaves, and Nguyen (1980) in their development of Services Evaluation Questionnaire, found that three items defined a unidimensional measure of satisfaction.

1. To what extent has our program met your needs?
2. In an overall general sense, how satisfied are you with the services you received?
3. If you were to seek help again, would you come back to our program?

These three items were used as a guideline for the initial development of items to assess satisfaction with learning experience.

Finally, in developing a measure to assess environmental aspects of a two-way audio/video classroom we interviewed ten distance education educators and four technicians from two large Midwestern universities. Specifically we asked them questions regarding their own experiences and their students' perceptions of the distance education environment. This information was then summarized and categorized into different environmental issues for two-way audio/video environments. Individual items were derived from these categories.

From these procedures a base of 64 items was developed. Next, three experts in the field of distance education were given the items and were asked to rate how accurately the items measured each of the constructs. Additionally, a rating procedure was used in which 97 novices, students in educational psychology courses, were given definitions for each construct, and asked to identify which construct or constructs each of the items seemed to measure.

The following definitions were used in each rating procedure:

Self-efficacy: Self-assessment of one's ability to be successful in a two-way audio/video classroom.

Satisfaction with the learning experience: How satisfied one was with their learning experiences in a two-way audio/video classroom.

Physical Environment: Perceptions of various physical characteristics of the two-way audio/video environment, such as audio, video, and so on.

Physical layout: Perceptions of the physical layout of a two-way audio/video classroom.

Management of the two-way audio/video classroom: Perceptions of how well the instructor and/or technology support team was able to successfully manage a distance learning environment. Management includes the support and use of the two-way audio/video technology, as well as regular classroom management.

Using these definitions, the novice raters were asked to categorize each item. Participants were allowed to choose one, multiple, or none of the constructs when making this decision. Next, concordance rates among these students were calculated. The experts followed a similar procedure.

The items eventually chosen for each of the scales had a wide range of frequency ratings from the novices. When examining these results, we looked at two specific areas. First we examined the percentage of identifications for the selected definition alone and then we looked at the number of identifications for something other than the selected definition. For the self-efficacy items there was a 72% - 90% selection of the self-efficacy definition alone for the items with no other choices or combinations above a 25% selection rate. For the satisfaction with learning experience there was a 26%-79% selection of the satisfaction with learning experience alone. The two items with the smaller confirmation rates had confirmations of 25% and 17% for the no matches choice which detracted from their overall concordance rate. The environmental variables, almost uniformly, were confirmed as one or a combination of the three environmental choices. The overall percentages for confirmations as one or a combination of the three environmental variables ranged from 48% - 98%, with only two of these items below the 75% rate. However, when these items were broken down into the three individual environmental categories the novices' confirmation rate dropped considerably. The only category with reasonable sole confirmation rates was the physical layout, with confirmation rates ranging from 60%-85%.

The concordance rates from the novices were examined in conjunction with the expert ratings. Based on these results, items were divided among the previously stated constructs.

Finally, each of these items was given to students in two-way audio/video classes. The students were asked to rate how strongly they agreed with each of the items. Ratings were given using a six point rating scale with one being **strongly disagree** and six **strongly agree**. Item analysis was performed using coefficient alphas. From this analysis 4 additional items were removed. These items did not provide any additional contribution to the measurement of the construct in question and detracted from the overall homogeneity of the measure. From these procedures five scales were developed to assess each of the constructs in question.

The measures included items such as; "Interacting via two-way audio/video is probably something I will be good at." (Perception of Self-Efficacy [SE]: 7 items); "I would take another two-way audio/video class" (Satisfaction with learning experience [SLE]: 6 items); "The lighting in the room is good" (Physical Environment [PE]: 7 items); "The layout of the room makes interacting with people at my site easy" (Physical Layout [PL]: 4 items); "The technology support for this course is good" (Management of the two-way audio/video classroom [MTAV]: 6 items). Reliability analysis was performed on each of the constructs. Each measure was found to have acceptable internal consistency (SE = 0.92; SLE = 0.90; PE = 0.77; PL = 0.77; MTAV = 0.71). Final scores for each of the measures were obtained by adding each of the items for the specific construct and then obtaining the mean.

Procedures

The data collection took place over two semesters. Nine classes participated during the spring semester of 1997, and 3 classes participated during the fall semester of 1997. During the 13th week of class, a questionnaire was administered to each participant. Prior to the administration of the questionnaires the participants received an informed consent form, and were asked to participate voluntarily in the study. Standard human subject procedures were followed as designated by each school's human subjects committee.

Analysis and Results

Scores on each of the five measures in question (SE, SLE, PE, PL, MTAV) were obtained for each of the students. In order to determine if the instruments were measuring different and distinct constructs, bivariate correlations were run. Each of the measures were significantly correlated to alpha = .01 level. The results of the correlation are displayed in table 1.

Table 1. Bivariate correlations for self-efficacy (SE), satisfaction with the learning experience (SLE), perception of the physical elements in the environment (PE), perception of the physical layout (PL), and perception of the management of the two-way audio/video classroom (MTAV).

	Post-SE	SLE	PE	PL	MTAV
SE	1.0				
SLE	.717**	1.0			
PE	.574**	.601**	1.0		
PL	.575**	.647**	.674**	1.0	
MTAV	.642**	.658**	.634**	.581**	1.0

(** Correlation is significant at .01, two-tailed.)

The results of the bivariate correlations indicate that all the variables are highly correlated with each other. Given such a high correlation level it was determined that additional analysis examining the relationship between these instruments was unwarranted. (Huberty & Morris, 1989).

Discussion

The results of the analysis lend themselves towards two possible interpretations. One interpretation is that the measures are assessing the same construct and not individual unique factors. This interpretation is based on the relatively high correlations found between the individual measures. It would seem, following this line of reasoning, that the students in question perceived the items in the same way.

A second possible interpretation of the data is that the participants' perceptions of the items are not due to their lack of uniqueness, but rather because they believe that their ability to succeed in a class is a function of how they perceive the two-way audio/video environment. Thus, high perceptions of two-way audio/video environmental issues would mean that students would most likely have high views of self-efficacy in such classes. Therefore, students' perceptions of the environment would be directly related and intimately tied to their perceptions of self-efficacy. This interpretation is supported by the fact that both experts and novices, who were not in a distance education class, interpreted the items for each of these measures as different, while participants in the two-way audio/video classroom perceived them as the same.

The results of this study provide an important first step. It appears that, at the very least, designers should consider students' perceptions of environmental elements and their relationship to students' self-efficacy when designing a two-way audio/video classroom. However, these results are far from conclusive and in order to make specific recommendations further research needs to be done.

Further Research

The issue of whether or not the instruments are measuring distinct constructs or are actually measuring only one unique construct needs to be investigated. This can be addressed in a variety of ways. Statistically, the validity and uniqueness of the constructs, or lack thereof, could be further obtained through additional data collection that would enable one to use such techniques as confirmatory analysis. In addition, examination of the measures and their relationship to measures that assess these constructs at either a specific or more general level would also provide more evidence to their proposed uniqueness. Unfortunately, in the case of the later, there are very few, if any empirically validated measures that assess the environmental aspects of a two-way audio/video environment (Biner, Dean, & Mellinger, 1994).

Perhaps the best way to determine if these are unique measures that are assessing tightly interwoven concepts is to develop a study that would seek to manipulate one specific area. In order to assess this, a controlled study would need to be developed in which one area being assessed was the only area changed between assessments. Although this would be difficult to develop, this would provide a much clearer answer to the question at hand.

This study sought to obtain a measurement of students' perceptions of the environment. The literature suggests that students' perceptions of the environment are likely to be related to their level of self-efficacy. While this study provides an important step in understanding the relationship between students' perceptions and self-efficacy, perception of environment must also be validated against expert observations of the environment, before any blanket decisions can be made about the design of a two-way audio/video classroom. If it is found that students' perceptions are accurate, these perceptions can lead to further refinement and investigation into which aspects of the environment are most relevant in respects to students' self-efficacy and satisfaction.

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